BACnet —

A Data Communication Protocol for Building Automation and Control Networks

for Acuvim II Series Power Meter

1 BACnet Overview

The Building Automation and Control Network (BACnet), described in the ANSI/ASHRAE Standard 135-1995, is one of the most widely used building management systems protocols.
BACnet was designed to allow communication of building automation and control systems for applications such as heating, ventilating, and air-conditioning control, lighting control, access control, and fire detection systems and their associated equipment. The BACnet protocol provides mechanisms for computerized building automation devices to exchange information, regardless of the particular building service they perform.

2 Introduction

The Acuvim II Series Power Meter has embedded BACnet IP communication，and also has embedded BACnet MS/TP communication. It communicates in native BACnet IP over Ethernet to seamlessly integrate with most building automation/control systems, and communicating with the BACnet MS/TP via the RS485. The Acuvim II Series Power Meter's BACnet IP and BACnet MS/TP has 56 predefined BACnet objects that let you track up to 56 measurements.
The Acuvim II Series Power Meter has native BACnet/IP that lets it act as a BACnet server in any BACnet application. The Acuvim II Series Power Meter’s BACnet IP also comes with a Web interface that is very easy to browse the parameter data by using a standard browser.

3 About BACnet Protocol

BACnet operates in a client-server environment. A client machine sends a service request (message) to a server machine; once the service is performed the results are reported back to the client machine. BACnet defines 5 groups (or classes) of 35 message types. For example, one class contains messages for retrieving and manipulating the object properties described above. An example of a common service request in this class is "ReadProperty." When the server machine receives this message from a client machine, it locates the requested property of the requested object and sends the value to the client.

The BACnet protocol consists of Objects that contain different kinds of information. Each Object has properties that contain data related to it. Below is the example of an Object for Total Watts:
Object_Name, **P_rms**
Object_Type, **AnalogValue**
Object_Instance, **17**
Present_Value, **watt**, tot (value in watts)

For more detailed information, visit the BACnet website at www.bacnet.org.

4 Using the Acuvim II Series Power Meter's BACnet

Serial and Ethernet versions

There are a couple of different serial and Ethernet based-versions of BACnet. The most common serial version is called BACnet MS/TP while the dominant Ethernet version is BACnet/IP.

BACnet/IP has been developed to allow the BACnet protocol to use TCP/IP networks. You could say that BACnet/IP is a way of hooking BACnet up to the Internet and communicate with different Local Area Networks (LANs). This enables system owners, facility managers, or even external suppliers to access BACnet networks and manage their devices and systems remotely.

BACnet MS/TP facts	
Network Type:	Serial RS-485 with a Master/Slave Token Passing protocol
Topology:	Line topology
Installation :	Any cable with at least 3 conductors can be used. Distance between nodes depends on baud rate.
Speed	9600 kbit/s,19200 kbit/s, 38400 kbit/s and 76800 kbit/s
max. Stations:	127 MS/TP masters
Data :	Up to 480 bytes per telegram frame

Table 4-1

BACnet/IP facts	
Network Type:	Ethernet based network using UDP for data transfer.
Topology:	Line or star topology (Standard Ethernet topology)
Installation :	Ethernet twisted pair cables with RJ45 connectors
Speed	10/100 Mbit/s full duplex
max. Stations:	No network limitation of number of nodes.
Data :	Up to 1476 bytes per frame

Table 4-2

5 Using The BACnet Module (AXM-BACnet)

5.1 Installation Method

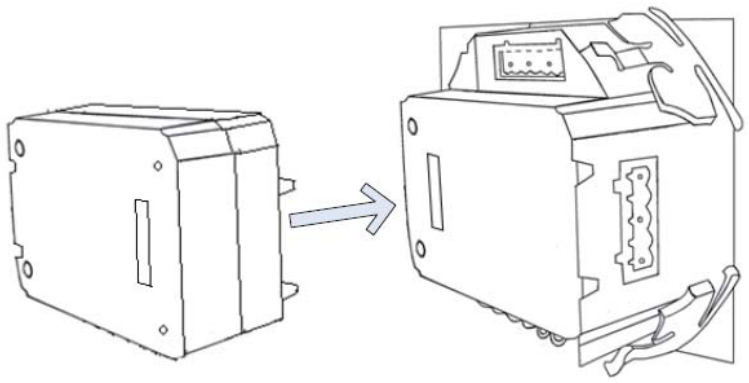


Figure 5-1

The BACnet module is linked to the Acuvim II meter by a communication plug. It can also be linked to other extended modules like IO modules.

1.Insert the installation clips to the counterpart of the meter, and then press the BACnet module lightly, so linking is established.

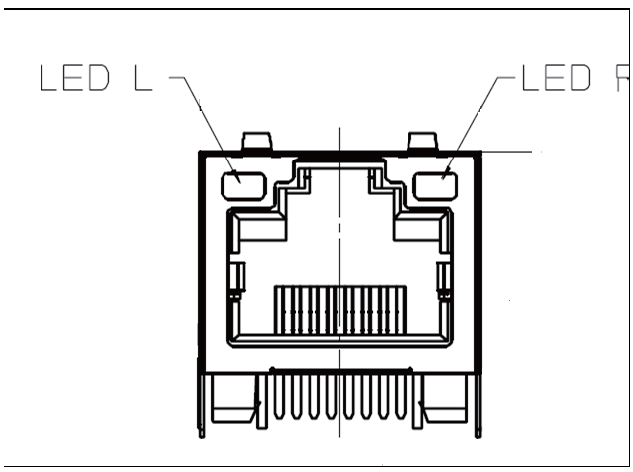
2.Tighten the installation screws.

Note:

1. Install BACnet Module carefully to avoid damage;
2. Under no circumstances should any installation be done with the meter powered on. Failure to do so may result in injury or death.

5.2 Definition of RJ45 Interface and 485 Interface

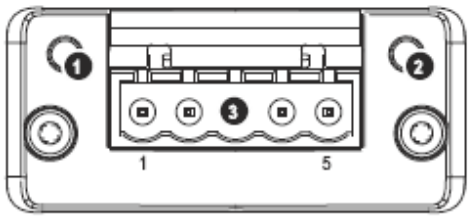
The BACnet/IP module uses a standard RJ45 connector to access the network. The mechanical and electrical characteristics of the connectors comply with the requirements of IEC 603-7.



Script	ID	Content
1	TX+	Tranceive Data+
2	TX-	Tranceive Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

The BACnet MS/TP module uses a standard 485 connector to access the network.

#	Item
1	Network Status LED
2	Module Status LED
3	BACnet connector



BACnet Connector

Pin number	Name	Description
1	Common	Signal common
2	Data-	Negative RS485 RxD/TxD
3	Shield	Cable shield
4	Data+	Positive RS485 RxD/TxD
5	(not used	

Figure 5-2

5.3 Initializing Ethernet Module

5.3.1 BACnet Module Enable Set

When the module is first used buy user，the information can be found by using the keys on the meter front. The following process shows how to configure BACnet module settings by using the front panel:

The initial structure module parameter steps：

a) Pressing “H” key and “V/A” key simultaneously on the meter will go to the menu selecting mode. Cursor “Meter” flashes in this mode.

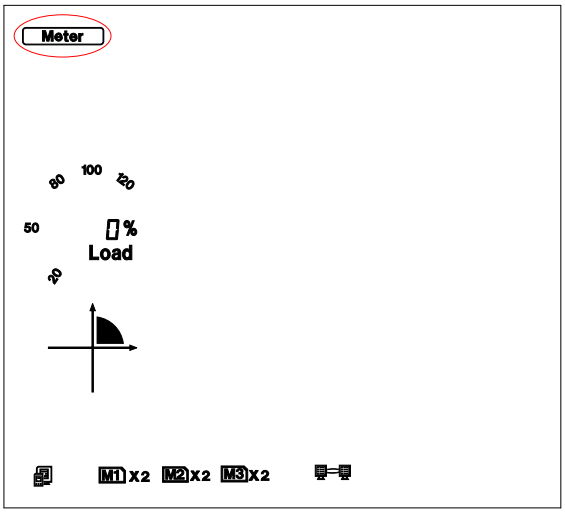


Figure 5-3

b) Press “P” key or “E” key to move the cursor to "Setting". Press “V/A” key to go to the meter parameter setting mode. Device address page is the first page of “Setting” mode. It shows the Modbus address of the device for several seconds, and then the screen goes to Access Code page. Press “V/A” key to go to the parameter setting page. Press “P” key or “E” key to move the cursor to "SYS". Press "V/A" key to go to the system setting page.

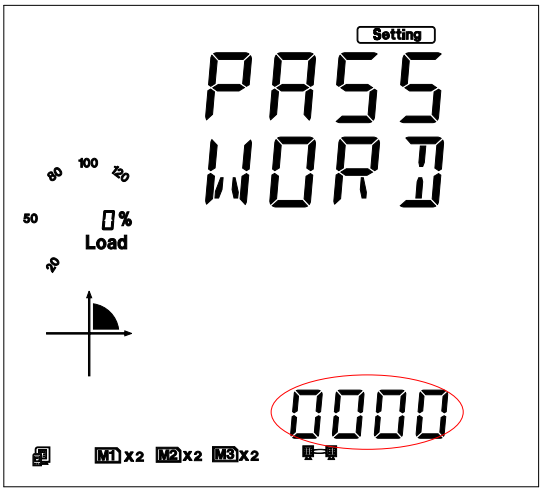


Figure 5-4

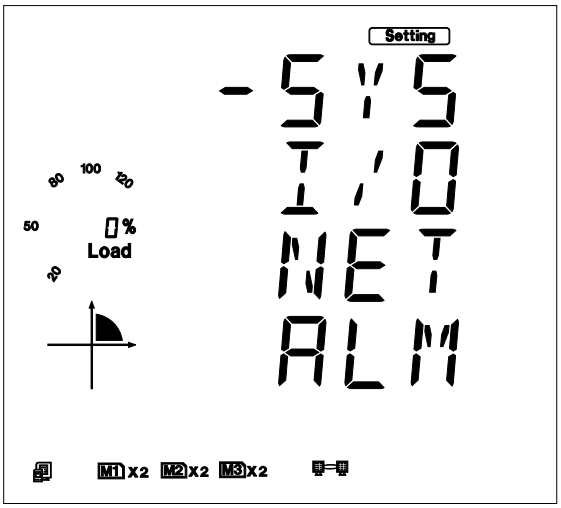


Figure 5-5

c) Press "V/A" key to go to the System setting page. The initial page is S01 the meter address page. Press “P” key or “E” key to move to S35 page .Then press "V/A" key to go to the BACnet protocol enable setting page. Press “P” key or “E” key to select configuration mode, press “V/A” key to accept and complete.

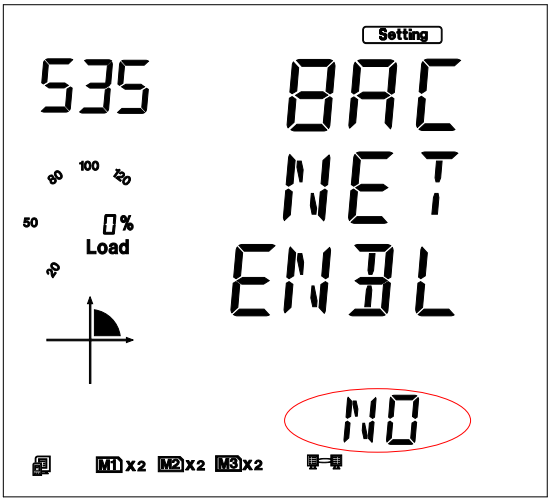


Figure 5-6

5.3.2 BACnet/IP module set

BACnet/IP Module's default settings are as follows:
IP Address (0.0.0.0);Subnet Mask (0.0.0.0);Gateway (0.0.0.0); DNS1 (0.0.0.0); DNS2 (0.0.0.0);

This information can be found by using the keys on the meter front. The following process shows how to configure BACnet module settings by using the front panel:

1. Pressing “H” key and “V/A” key simultaneously on the meter will go to the menu selecting mode. Cursor “Meter” flashes in this mode.

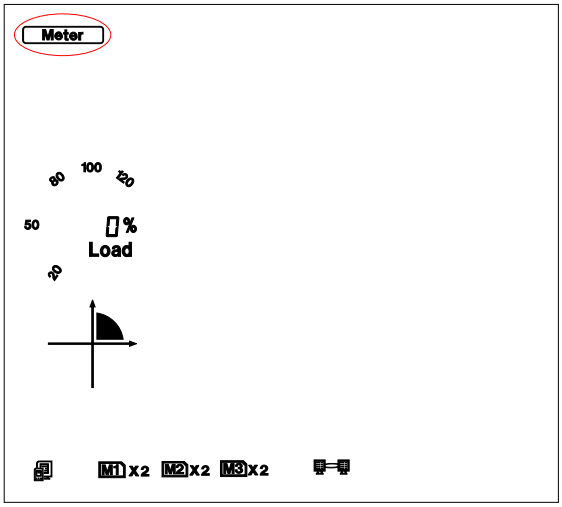


Figure 5-7

2. Press “P” key or “E” key to move the cursor to "Setting". Press “V/A” key to go to the meter parameter setting mode. Device address page is the first page of “Setting” mode. It shows the Modbus address of the device for several seconds, and then the screen goes to Access Code page. Press “V/A” key to go to the parameter setting page. Press “P” key or “E” key to move the cursor to "NET". Press "V/A" key to go to the BACnet module setting page.

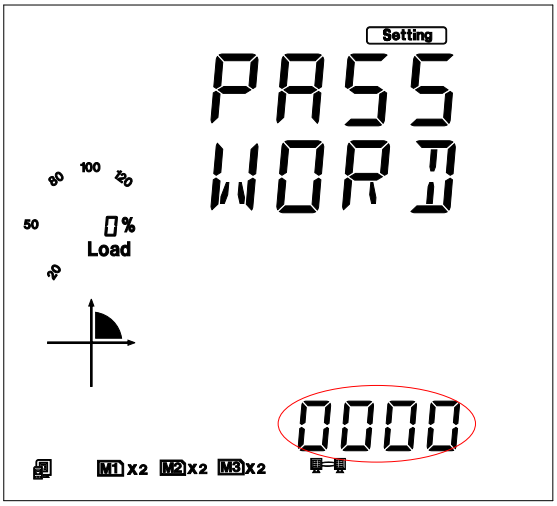


Figure 5-8

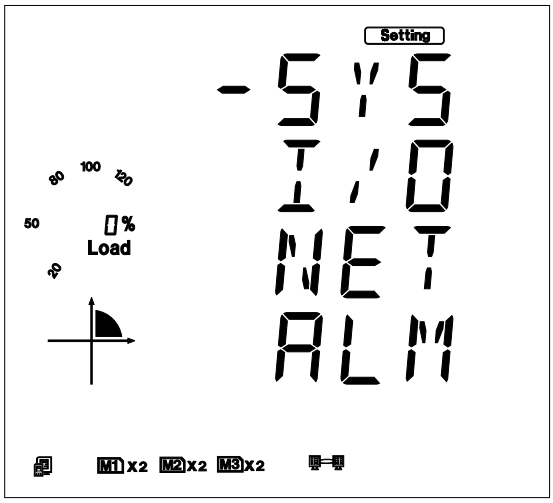


Figure 5-9

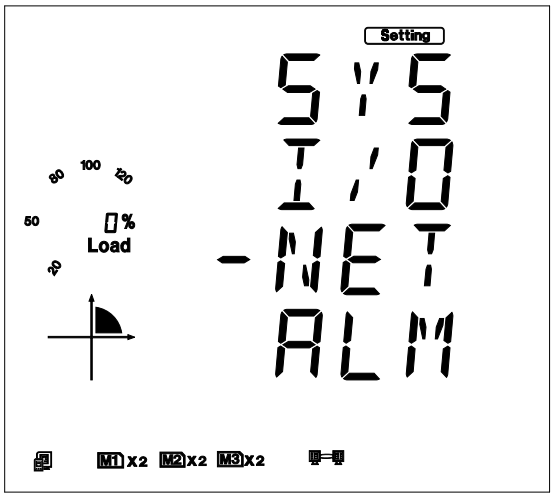


Figure 5-10

3. Set configuration mode in the first setting page. “AUTO” means that users configure module settings with DHCP protocol while “MANU” means that users configure module settings with manual setting. Press “V/A” key, to go to the setting state and the area pointed out in Figure 5-11 will flash. Press “P” key or “E” key to select configuration mode, press “V/A” key to accept. Press the "P" key again to go to the second setting page for IP Address.

Note: If you select the “AUTO” mode, please go to step 10 directly and reset module. Wait until the reset is finished and find the new IP address in the following step.

Figure 5-11

4. Set IP Address in the second setting page, such as 192.168.1.100 as shown below. Press the "V/A" key to go to the IP setting page. Users may set the parameters in the area pointed out in Figure 5-12. The cursor starts at the first digit. After setting the IP address press the "V/A" key to accept. Press the "P" key again to go to the third setting page for Subnet Mask.

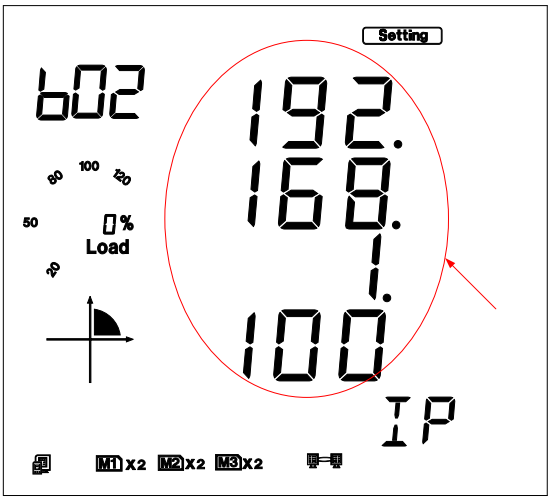


Figure 5-12

5. Set Subnet Mask in the third setting page, such as 255.255.255.0. Press “V/A” key to go to the setting page. Users may set the parameters in the area pointed out in Figure 5-13. The cursor starts at the first digit. After setting the Subnet Mask, press the "V/A" key to accept. Press the "P" key again to go to the fourth setting page for Gateway.

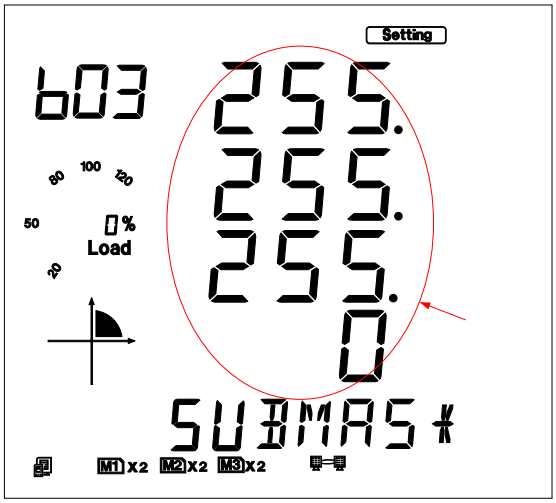


Figure 5-13

6. Set Gateway in the fourth setting page, such as 192.168.1.1. Press the "V/A" key to go to the setting page. Users may set the parameters pointed out in Figure 5-14. The cursor starts at the first digit. After setting the Gateway, press the "V/A" key to accept. Press the "P" key to go to the fifth setting page for DNS Primary Server.

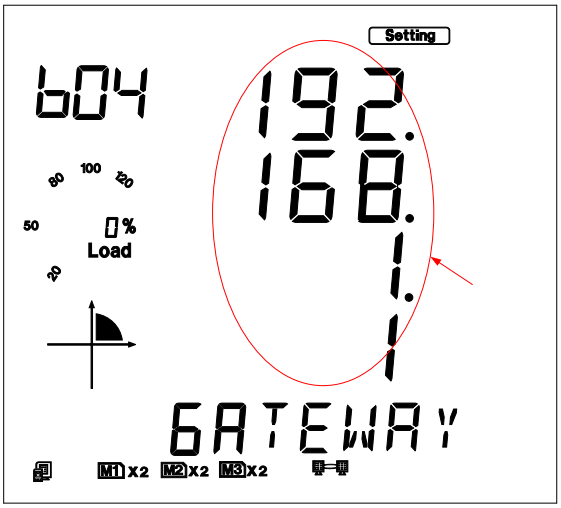


Figure 5-14

7. Set DNS Primary Server in the fifth setting page, such as 202.106.0.20. Press the "V/A" key to go to the setting page. Users may set the parameters pointed out in Figure 5-15. The cursor starts at the first digit. After setting the DNS Primary Server, press the "V/A" key to accept. Press the "P" key to go to the sixth setting page for DNS Secondary Server.

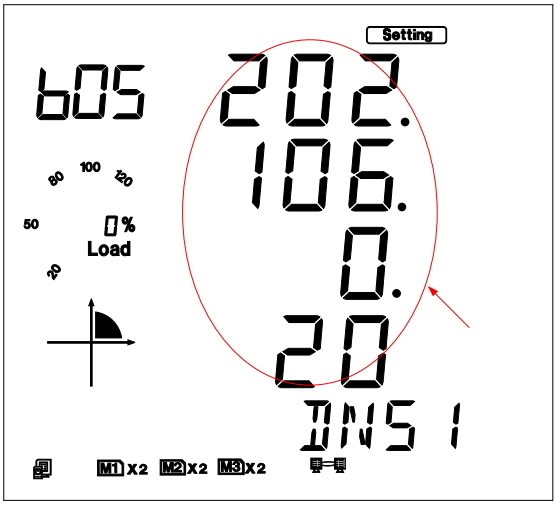


Figure 5-15

8. Set DNS Secondary Server in the sixth setting page, such as 202.106.196.115. Press the "V/A" key to go to the setting page. Users may set the parameters pointed out in Figure 5-16. The cursor starts at the first digit. After setting the DNS Secondary Server, press the "V/A" key to accept. Press the "P" key to go to the seventh setting page for the BACnet/IP port.

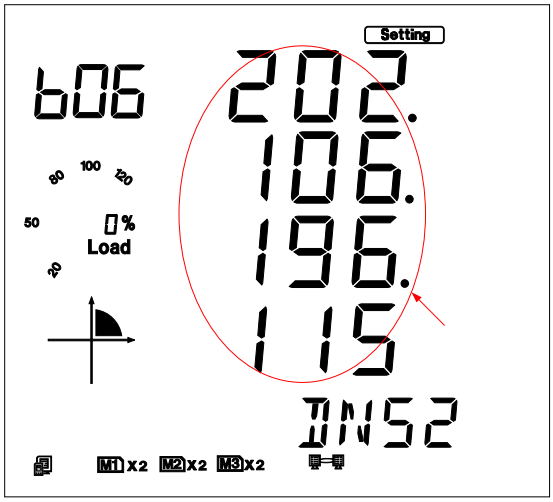


Figure 5-16

9. Set BACnet/IP port in the seventh setting page, such as 47808. Press the "V/A" key to go to the setting page. Users may set the parameters pointed out in Figure 5-17. The cursor starts at the first digit. The BACnet/IP port's default value is 47808, and the user defined range of port is 1~65535. After setting the BACnet/IP port, press the "V/A" key to accept. Press the "P" key to go to the eighth setting page for the BACnet RESET.

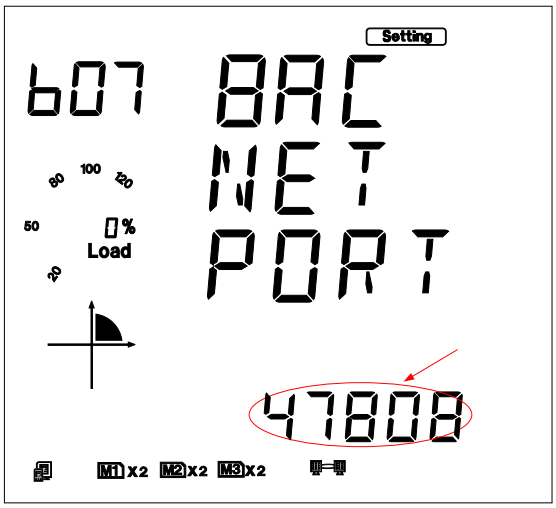


Figure 5-17

10. Set resetting mode in the eighth setting page. Select “RESET” to reset the module. Selecting “NO” will not reset the module. Press the "V/A" key to go to the setting page and the parameter pointed out in Figure 5-18 will flash.Press the "P" or "E" key to select the configuration mode. Press the "V/A" key to accept.
Note: When configuring BACnet module settings completely, users must select “RESET” to restart module and new settings will take effect.

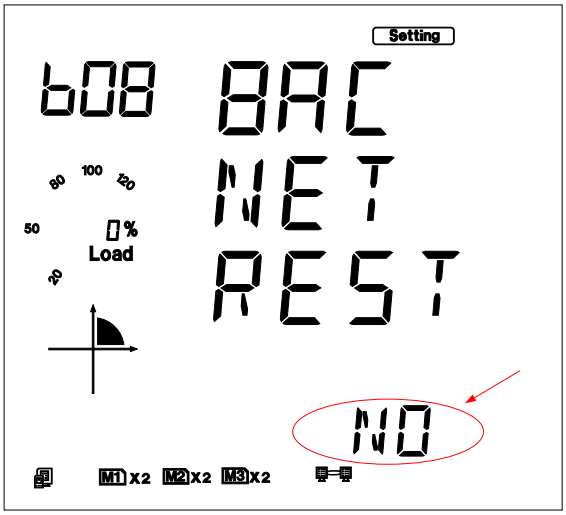


Figure 5-18

11. After configuring AXM-BACnet settings completely, press “H” key and “V/A” key simultaneously to return to menu selecting mode.

5.3.3 BACnet MS/TP module set

BACnet MS/TP Module's default settings are as follows：
MAC Addr(0)；BACnet Bps(9600)；Max Info Pram(1)。

This information can be found by using the keys on the meter front. The following process shows how to configure BACnet module settings by using the front panel:

1. Pressing “H” key and “V/A” key simultaneously on the meter will go to the menu selecting mode. Cursor “Meter” flashes in this mode.

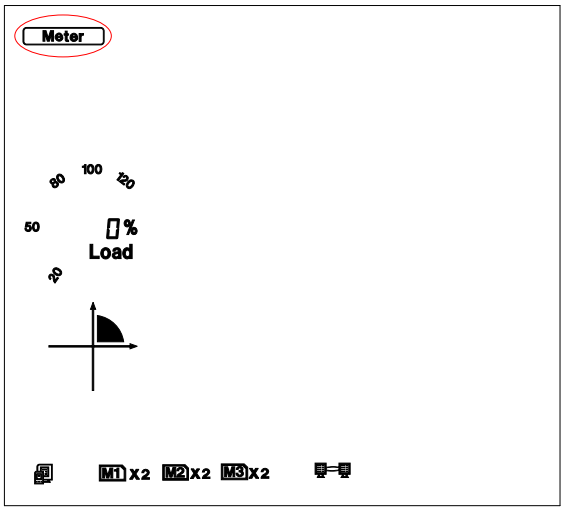


Figure 5-19

2. Press “P” key or “E” key to move the cursor to "Setting". Press “V/A” key to go to the meter parameter setting mode. Device address page is the first page of “Setting” mode. It shows the Modbus address of the device for several seconds, and then the screen goes to Access Code page. Press “V/A” key to go to the parameter setting page. Press “P” key or “E” key to move the cursor to "NET". Press "V/A" key to go to the BACnet module setting page.

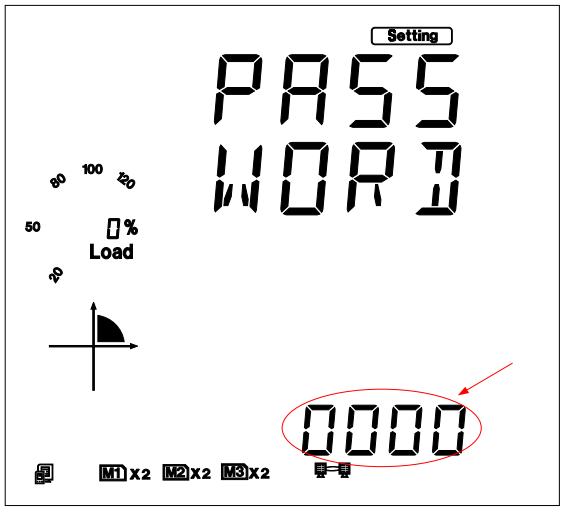


Figure 5-20

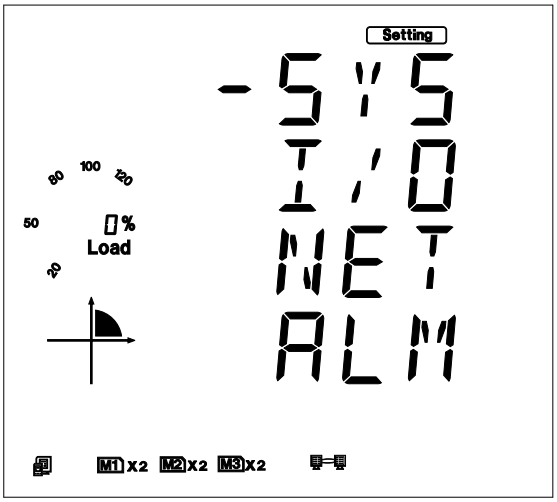


Figure 5-21

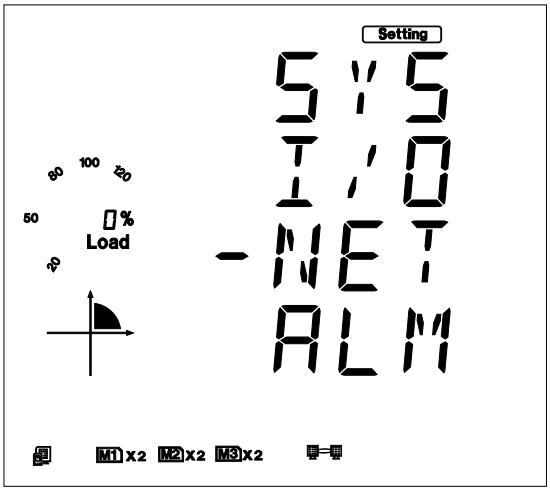


Figure 5-22

3) Set module address in the first setting page. Press the "V/A" key to go to the setting page. Users may set the parameters pointed out in Figure 5-23. The cursor starts at the first digit. The BACnet MS/TP Address's default value is 0, and the user defined range of address is 0~127. After setting the BACnet MS/TP Address, press the "V/A" key to accept. Press the "P" key to go to the second setting page for the baud rate.

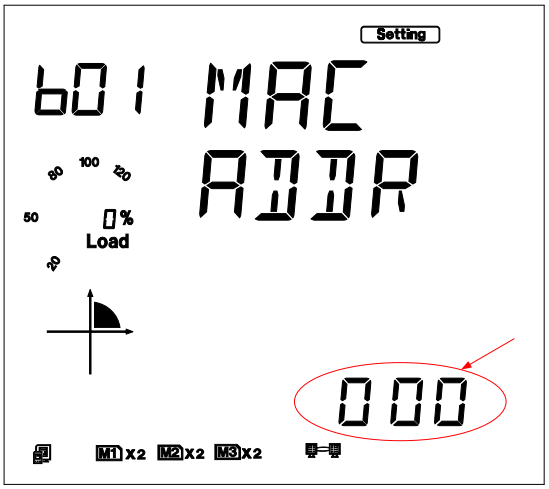


Figure 5-23

4) Set Baud Rate in the second setting page ，such as 38400.The module can support the baud rate such as 9600,19200,38400,76800。Press the "V/A" key to go to the setting page.， Users may set the parameters pointed out in Figure 5-24。After setting the BACnet MS/TP Baud rate, press the "V/A" key to accept. Press the "P" key to go to the third setting page for the MAX INFO FRAM.

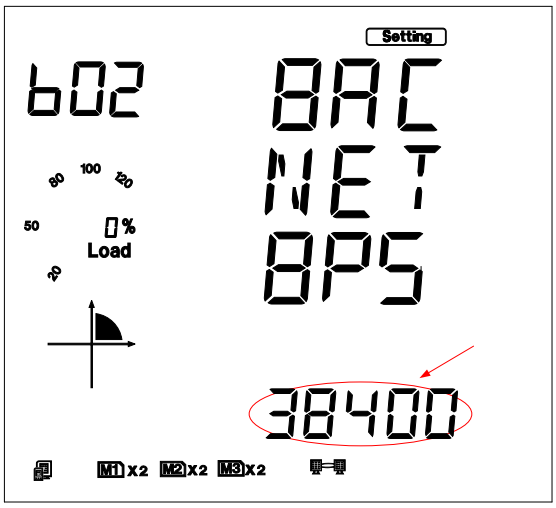


Figure 5-24

5) Set MAX INFO FRAM in the third setting page，such as 1。The BACnet MS/TP MAX INFO FRAM default value is 1, and the user defined range of MAX INFO FRAM is 1~255. Users may set the parameters pointed out in Figure 5-25。 After setting the BACnet MS/TP MAX INFO FRAM, press the "V/A" key to accept. Press the "P" key to go to the fourth setting page for the module reset.

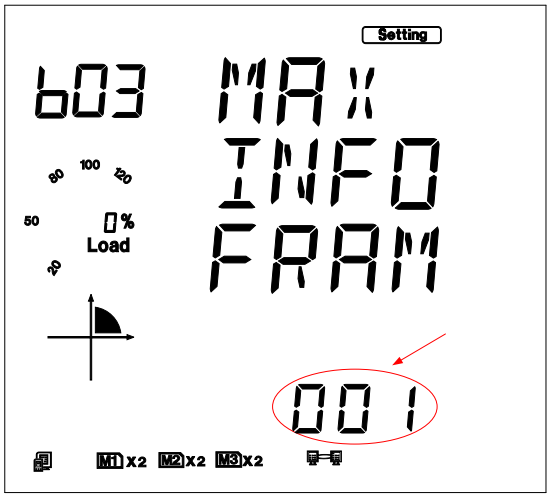


Figure 5-25

6) Set resetting mode in the fourth setting page. Select “RESET” to reset the module. Selecting “NO” will not reset the module. Selecting "RESET" will load the module with modify settings. Press the "V/A" key to go to the setting page and the parameter pointed out in Figure 5-26 will flash. Press the "P" or "E" key to select the configuration mode. Press the "V/A" key to accept.

Note: When configuring BACnet module settings completely, users must select “RESET” to restart module and new settings will take effect.

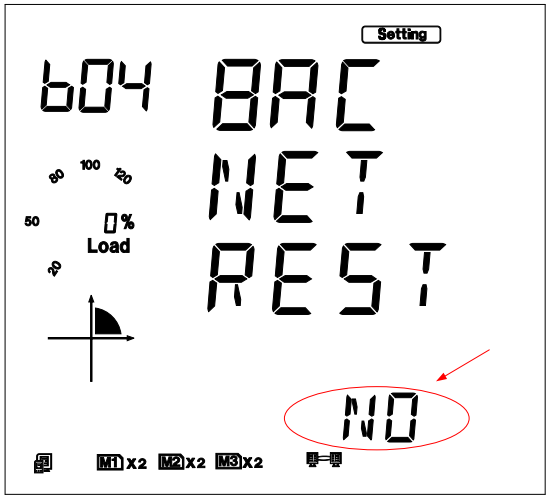


Figure 5-26

7. After configuring AXM-BACnet settings completely, press “H” key and “V/A” key simultaneously to return to menu selecting mode.

6 Acuvim II Series Power Meter's BACnet Objects

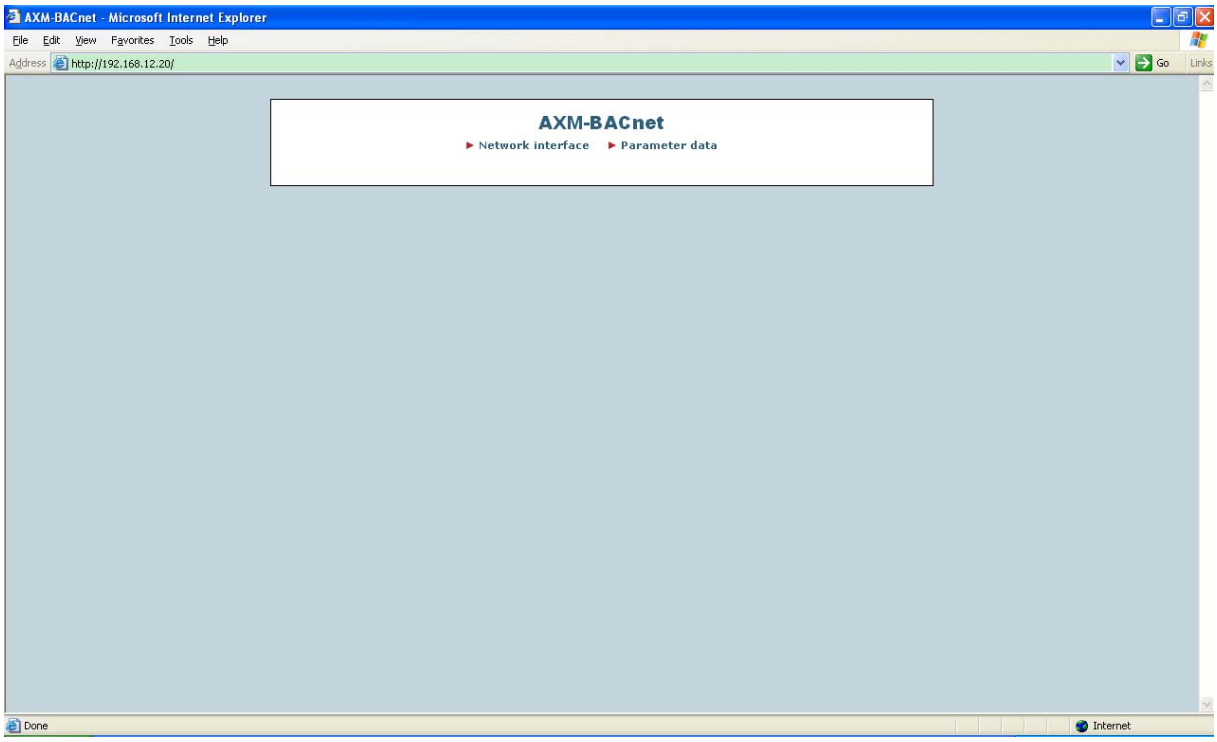
The Acuvim II Series Power Meter's BACnet IP has 56 predefined objects of electrical measurements. No programming or mapping is necessary to use the BACnet objects. The object's names easily identify the measurements they contain. All of the objects, with the exception of Modbus Meter and POLL_DELAY are AI (analog input) Object type. The following table lists each of the objects with their units of measurement and description.

ObjectType	Instance	Name	Object DataType	Value	Descriptor
AnalogValue	0	Freq_rms	FLOAT	ADI1	Frequency
AnalogValue	1	Ua_rms	FLOAT	ADI2	Voltage A
AnalogValue	2	Ub_rms	FLOAT	ADI3	Voltage B
AnalogValue	3	Uc_rms	FLOAT	ADI4	Voltage C
AnalogValue	4	Uvag_rms	FLOAT	ADI5	Phrase Voltage Avg
AnalogValue	5	Uab_rms	FLOAT	ADI6	Voltage A-B
AnalogValue	6	Ubc_rms	FLOAT	ADI7	Voltage B-C
AnalogValue	7	Uca_rms	FLOAT	ADI8	Voltage C-A
AnalogValue	8	Ulag_rms	FLOAT	ADI9	Line Voltage Avg
AnalogValue	9	Ia_rms	FLOAT	ADI10	Current A
AnalogValue	10	Ib_rms	FLOAT	ADI11	Current B
AnalogValue	11	Ic_rms	FLOAT	ADI12	Current C
AnalogValue	12	Ivag_rms	FLOAT	ADI13	Current Average
AnalogValue	13	In_rms	FLOAT	ADI14	Neutral Current
AnalogValue	14	Pa_rms	FLOAT	ADI15	Pa
AnalogValue	15	Pb_rms	FLOAT	ADI16	Pb
AnalogValue	16	Pc_rms	FLOAT	ADI17	Pc
AnalogValue	17	P_rms	FLOAT	ADI18	Total Active Power
AnalogValue	18	Qa_rms	FLOAT	ADI19	Qa
AnalogValue	19	Qb_rms	FLOAT	ADI20	Qb
AnalogValue	20	Qc_rms	FLOAT	ADI21	Qc
AnalogValue	21	Q_rms	FLOAT	ADI22	Total Reactive Power
AnalogValue	22	Sa_rms	FLOAT	ADI23	Sa
AnalogValue	23	Sb_rms	FLOAT	ADI24	Sb
AnalogValue	24	Sc_rms	FLOAT	ADI25	Sc
AnalogValue	25	S_rms	FLOAT	ADI26	Total Apparent Power
AnalogValue	26	PFa_rms	FLOAT	ADI27	PFa
AnalogValue	27	PFb_rms	FLOAT	ADI28	PFb
AnalogValue	28	PFc_rms	FLOAT	ADI29	PFc
AnalogValue	29	PF_rms	FLOAT	ADI30	Total Power Factor
AnalogValue	30	Unbl_u2	FLOAT	ADI31	Voltage Imbalance
AnalogValue	31	Unbl_i2	FLOAT	ADI32	Current Imbanacne

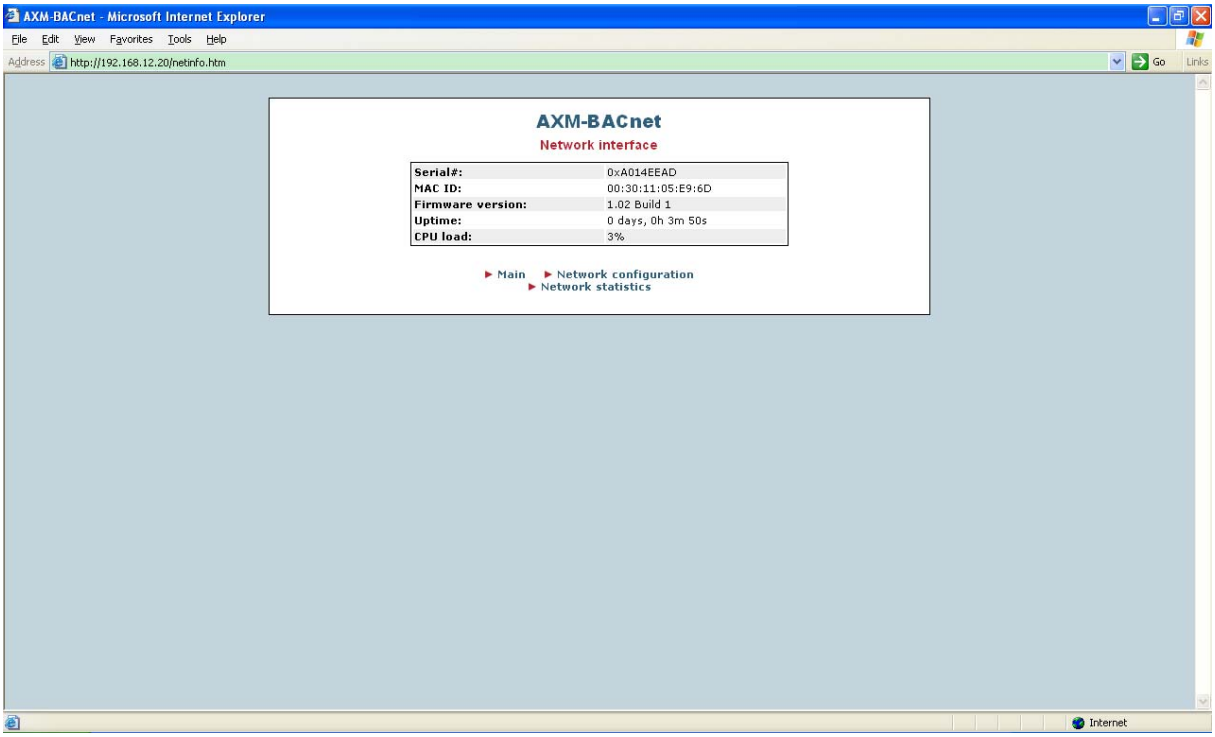
AnalogValue	32	Rlc_val	FLOAT	ADI33	Load Characteristics
AnalogValue	33	P_dema	FLOAT	ADI34	P Demand
AnalogValue	34	Q_dema	FLOAT	ADI35	Q Demand
AnalogValue	35	S_dema	FLOAT	ADI36	S Demand
AnalogValue	36	Ia_Demand	FLOAT	ADI37	Ia Demand
AnalogValue	37	Ib_Demamd	FLOAT	ADI38	Ib Demamd
AnalogValue	38	Ic_Demand	FLOAT	ADI39	Ic Demand
AnalogValue	39	Active_Energy_IMP	UINT32	ADI40	Active_Energy_ IMP
AnalogValue	40	Active_Energy_EXP	UINT32	ADI41	Active_Energy_EXP
AnalogValue	41	Reactive_Energy_IMP	UINT32	ADI42	Reactive_Energy_ IMP
AnalogValue	42	Reactice_Energy_EXP	UINT32	ADI43	Reactice_Energy_EXP
AnalogValue	43	Active_Energy_TOTAL	UINT32	ADI44	Active_Energy_TOTAL
AnalogValue	44	Active_Energy_NET	SINT32	ADI45	Active_Energy_NET
AnalogValue	45	Reactive_Energy_TOTAL	UINT32	ADI46	Reactive_EnergyTOTAL
AnalogValue	46	Reactive_Energy_NET	SINT32	ADI47	Reactive_Energy_NET
AnalogValue	47	Apprent_Energy	UINT32	ADI48	Apprent_Energy
AnalogValue	48	THD_V1	UINT16	ADI49	THD_V1
AnalogValue	49	THD_V2	UINT16	ADI50	THD_V2
AnalogValue	50	THD_V3	UINT16	ADI51	THD_V3
AnalogValue	51	THD_V	UINT16	ADI52	THD_V
AnalogValue	52	THD_ I1	UINT16	ADI53	THD_ I1
AnalogValue	53	THD_ I2	UINT16	ADI54	THD_ I2
AnalogValue	54	THD_ I3	UINT16	ADI55	THD_ I3
AnalogValue	55	THD_I	UINT16	ADI56	THD_I

7 Browse the web server

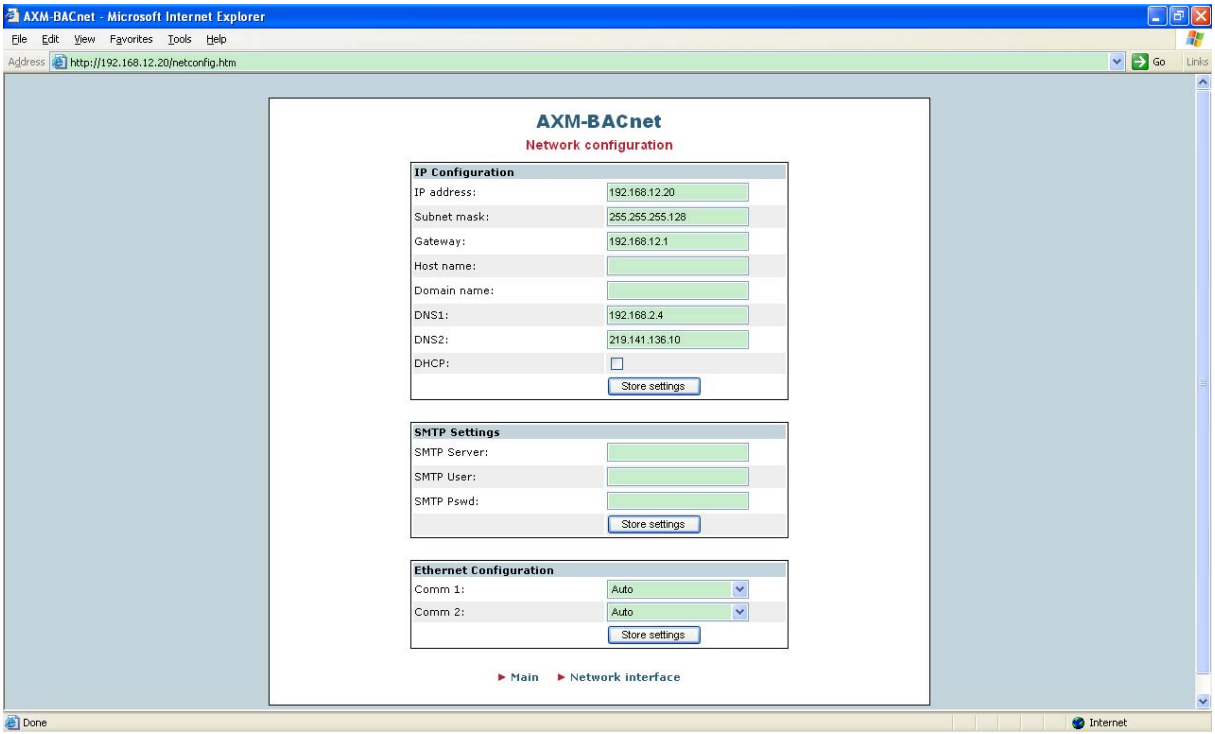
1) Configure your Power Meter, make sure your module connected to your computer or access LAN.
2) Consult your module IP through the meter front panel.
3) Open your web browser and connect to the meter at the address you found on the Meter.
4) Then you will come to the main page.



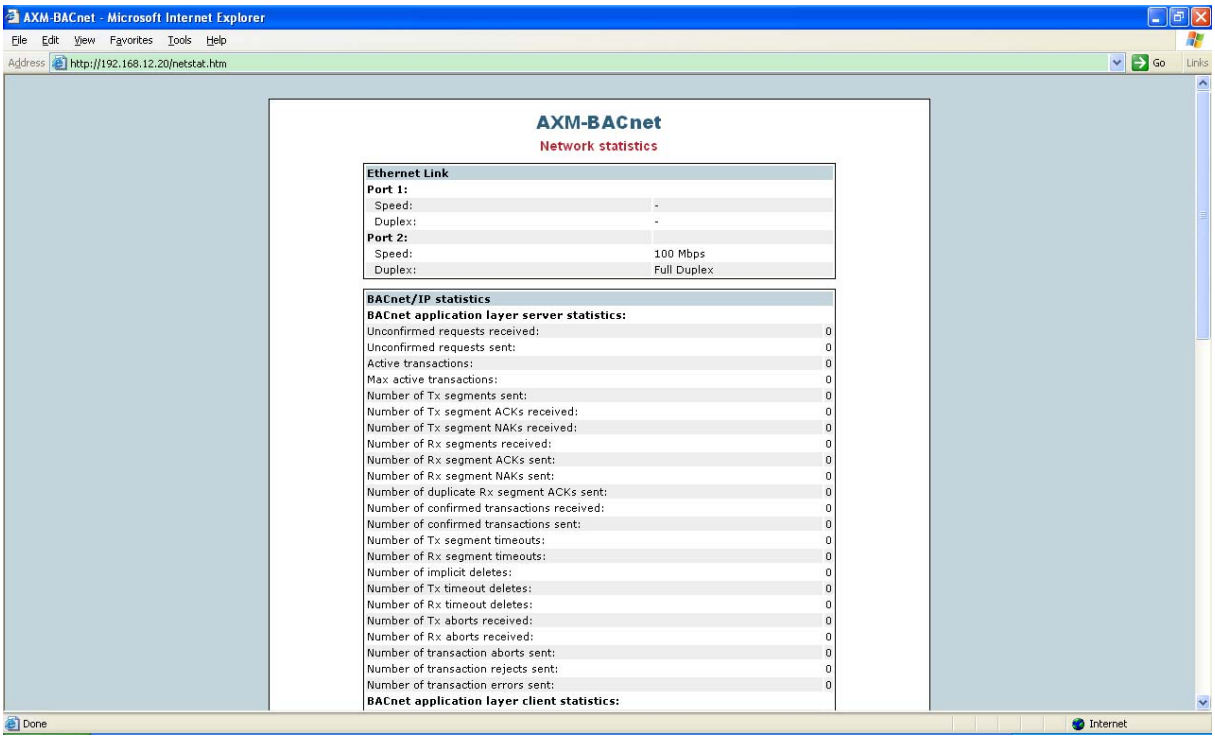
5) Click the Network interface, you will see network information.

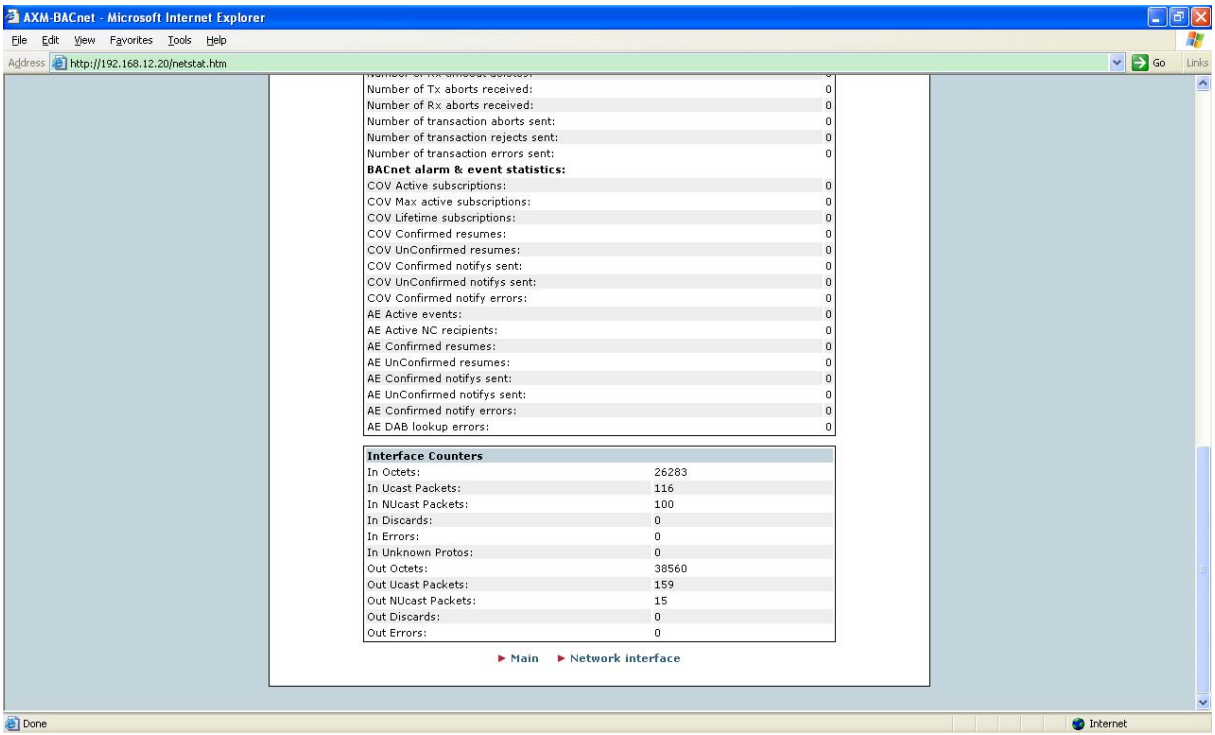


6) Click the Network configuration, you will see network configure page, it is something about the IP setting parameter.

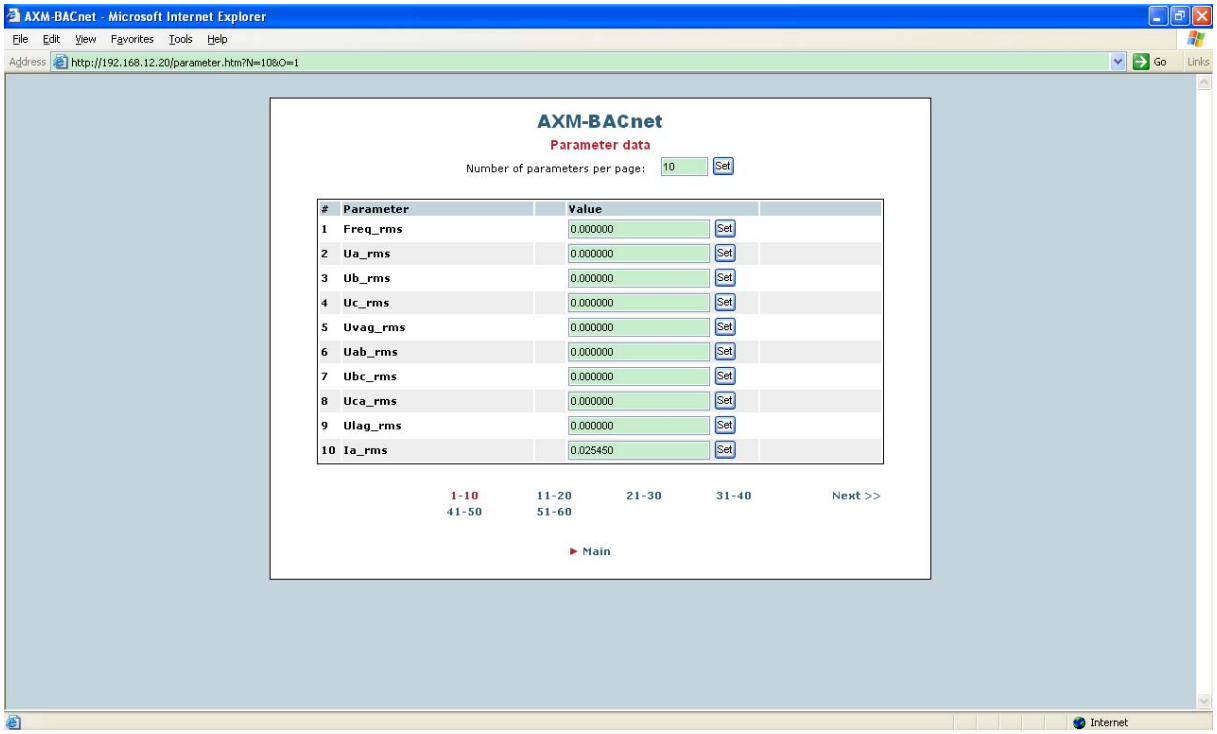


7) Click the Network statistics, you will see network status page, it is something about the module network parameter status.


AXM-BACnet - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://192.168.12.20/netstat.htm
Go
Links
AXM-BACnet
Network statistics
Ethernet Link
Port 1:
Speed: -
Duplex: -
Port 2:
Speed: 100 Mbps
Duplex: Full Duplex
BACnet/IP statistics
BACnet application layer server statistics:
Unconfirmed requests received: 0
Unconfirmed requests sent: 0
Active transactions: 0
Max active transactions: 0
Number of Tx segments sent: 0
Number of Tx segment ACKs received: 0
Number of Tx segment NAKs received: 0
Number of Rx segments received: 0
Number of Rx segment ACKs sent: 0
Number of Rx segment NAKs sent: 0
Number of duplicate Rx segment ACKs sent: 0
Number of confirmed transactions received: 0
Number of confirmed transactions sent: 0
Number of Tx segment timeouts: 0
Number of Rx segment timeouts: 0
Number of implicit deletes: 0
Number of Tx timeout deletes: 0
Number of Rx timeout deletes: 0
Number of Tx aborts received: 0
Number of Rx aborts received: 0
Number of transaction aborts sent: 0
Number of transaction rejects sent: 0
Number of transaction errors sent: 0
BACnet application layer client statistics:
Done
Internet



8) At the main page. Click the Paramater data, you will see all the parameter data, it is real time parameter data for communication.


AXM-BACnet - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://192.168.12.20/parameter.htm?N=108&O=1
Go
Links
AXM-BACnet
Parameter data
Number of parameters per page: 10 Set
Parameter Value
1 Freq_rms 0.000000 Set
2 Ua_rms 0.000000 Set
3 Ub_rms 0.000000 Set
4 Uc_rms 0.000000 Set
5 Uvag_rms 0.000000 Set
6 Uab_rms 0.000000 Set
7 Ubc_rms 0.000000 Set
8 Uca_rms 0.000000 Set
9 Ulag_rms 0.000000 Set
10 Ia_rms 0.025450 Set
1-10 11-20 21-30 31-40 Next >>
41-50 51-60
Main
Internet